Claims:

1. Process for stripping residual volatile compounds contained in a thermoplastic polymer, characterized in that it comprises the following steps:

(1) forming the polymer in the form of a melt flowing as a main stream;

(2) forming a foaming agent in the form of one or more secondary liquid streams;

(3) adding the secondary liquid stream(s) to the main stream by spraying so as to divide each secondary liquid stream into several fractional streams and thus to form a polymer melt/foaming agent pre-mixture;

(4) introducing the pre-mixture into a static mixer, then into an expansion chamber at reduced pressure so as to separate the polymer melt from the residual volatile compounds and from the foaming agent; and

(5) withdrawing the polymer melt, thus stripped of the residual volatile compounds and of the foaming agent, from the expansion chamber.

2. Process according to Claim 1, characterized in that the thermoplastic polymer is chosen from olefin polymers and aromatic vinyl polymers, preferably from styrene (co-)polymers.

3. Process according to Claim 1 or 2, characterized in that the foaming agent is chosen from water, alcohols, especially C_1 to C_{10} alcohols, ketones, especially C_3 to C_{10} ketones, an aqueous carbon dioxide solution, and mixtures of two or more of these products.

4. Process according to any one of Claims 1 to 3, characterized in that each secondary liquid stream is divided, by spraying, into at least two, preferably into at least three, especially into at least four, fractional streams.

5. Process according to any one of Claims 1 to 4, characterized in that the fractional streams are oriented in a direction making a right, acute or zero angle, preferably an acute or zero angle, with the direction of the main stream.

6. Process according to any one of Claims 1 to 5, characterized in that at least one of the fractional streams is oriented in a direction equivalent to the direction of the main stream or substantially in this direction, while at least one of the other fractional streams is oriented in a direction making an angle of greater than 20° and less than or equal to 90°, preferably an angle of greater than 20° and less than 90°, especially an angle ranging from 30° to 80°, with the direction of the said main stream.

7. Process according to any one of Claims 1 to 6, characterized in that the secondary liquid stream(s) is(are) added to the main stream at the moment when the latter is subjected to a constriction that particularly comprises, in succession in the direction of flow of the main stream, a decompression phase followed by a compression phase.

8. Process according to Claim 7, characterized in that the secondary liquid stream(s) is(are) added to the main stream between the decompression and compression phases, or preferably during the compression phase.

9. Apparatus for removing residual volatile compounds contained in a thermoplastic polymer, characterized in that it comprises:

- a polymer melt feed line;
- an addition chamber into which the feed line runs and through which the polymer melt flows as a main stream;
- one or more line(s) for the addition of a foaming agent flowing as one or more secondary liquid streams, which line(s) runs (run) into the addition chamber and has (have) at its (their) end(s) a spray device allowing each secondary liquid stream to be divided into several fractional streams;
- a static mixer having an inlet, connected to the addition chamber, and an outlet; and
- an expansion chamber for separating the polymer melt from the residual volatile compounds and from the foaming agent, which chamber is connected to the outlet of the static mixer and is provided with a line for withdrawing the polymer melt thus separated and with a line for extracting the residual volatile compounds and the foaming agent.

10. Apparatus according to Claim 9, characterized in that the spray device consists of a closed nozzle placed on the end of the addition line and pierced by several orifices, the number of which is equivalent to the number of fractional streams to be formed.

11. Apparatus according to Claim 10, characterized in that the number of orifices per nozzle is at least 2, preferably at least 3, especially at least 4.

12. Apparatus according to Claim 10 or 11, characterized in that the orifices are oriented in such a way that the resulting fractional streams are directed along a direction making a right, acute or zero angle, preferably an acute or zero angle, with the direction of the main stream flowing through the addition chamber.

13. Apparatus according to any one of Claims 10 to 12, characterized in that at least one of the orifices is directed in such a way that the resulting fractional stream is oriented in a direction equivalent to the direction of the main stream flowing through the addition chamber or substantially in this direction, while at least one of the other orifices is directed in such a way that the resulting fractional stream is oriented in a direction making an angle of greater than 20° and less than or equal to 90°, preferably an angle of greater than 20° and less than 90°, especially an angle ranging from 30° to 80°, with the direction of the said main stream.

14. Apparatus according to any one of Claims 9 to 13, characterized in that the addition chamber comprises a constriction zone having especially, in the direction of flow of the main stream, in succession an upstream or convergent section and a downstream or divergent section, the narrowest part of the zone being located between the two sections.

15. Apparatus according to Claim 14, characterized in that the constriction device is placed in the narrowest part of the constriction zone or preferably in the downstream or divergent section of the said zone.

16. Apparatus according to any one of Claims 9 to 15, characterized in that the addition chamber is contiguous with the inlet of the static mixer.